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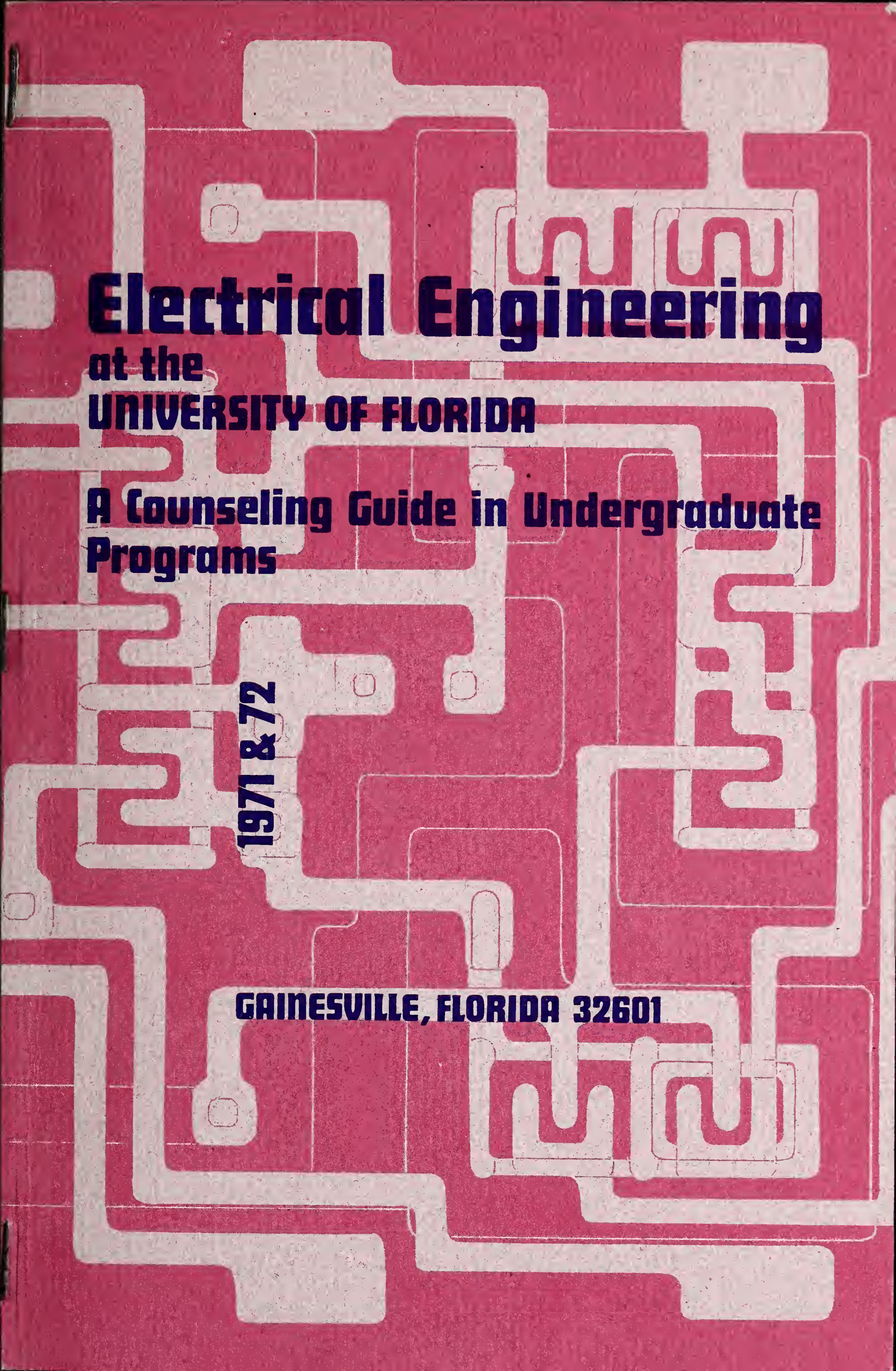

Electrical Engineering
at the
UNIVERSITY OF FLORIDA

A Counseling Guide in Undergraduate Programs

1971 & 72

GAINESVILLE, FLORIDA 32601

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PREFACE

This document contains a description of Electrical Engineering with abbreviated course descriptions. Within Electrical Engineering at the University of Florida there are currently six optional fields; Biomedical Engineering, Communication Theory, Computer Science, Electric Energy Engineering, Electronics and Systems.

The purpose of this pamphlet is to provide a single source of information to assist a student who is in or plans to enter an undergraduate program in Electrical Engineering thereby reducing his need for personal discussion with a counselor. However, there will be occasions when the student should discuss his program or other problems with a counselor and individuals are always available to him for this purpose.

Dr. Wayne H. Chen
Chairman
Department of Electrical Engineering

Nelson E. Rosier
Undergraduate Coordinator

William F. Kaiser
Undergraduate Counselor

Mark H. Smallwood
Undergraduate Counselor

Dr. John R. O'Malley
Graduate Coordinator

FACULTY

Bailey, R.L. (Assistant Professor) M.S.E. (University of Florida) Creativity, Direct Energy Conversion, Electromechanics, Electric Energy Engineering, Electronics.

Bailey, T.L. (Professor) Ph.D. (Physical Chemistry) (University of Chicago) Chemical Physics, Electronic and Ionic Collisions, Mass Spectroscopy.

Boykin, W.J., Jr. (Assistant Professor) Ph.D. (Stanford) Optimal Control Theory and Applications to Aerospace Systems and Structural Dynamics, Man Machine Systems, Digital Control Systems.

Brodersen, A.J. (Associate Professor) Ph.D. (University of California) Electronic Circuits and Devices, Especially as Applied to Integrated Circuits.

Bullock, T.E. (Associate Professor) Ph.D. (Stanford) Optimal Control Theory, Hybrid, Computation.

Chen, W.H. (Professor and Department Chairman) Ph.D. (University of Washington) Network Analysis and Synthesis, Switching Circuits.

Chenette, E.R. (Professor) Ph.D. (University of Minnesota) Micro-electronics, Semiconductors, Noise and Electrical Material and Devices.

Childers, D.G. (Professor) Ph.D. (University of Southern California) Noise, Communication and Information Theory, Biomedical Engineering with Applications to Modeling and Data Processing.

Couch, L.W. (Assistant Professor) Ph.D. (University of Florida) Communication Theory and Its Application with Special Interest in Modulation Systems and Methods.

Cross, J.L. (Assistant Professor) Ph.D. (University of Florida) Communication Systems, Antennas.

Director, S.W. (Assistant Professor) Ph.D. (University of California, Berkeley) Computer Aided Network Design, Circuit Theory.

Dominiak, K.E. (Visiting Assistant Professor) Ph.D. (Polytechnic Institute of Brooklyn) Systems Analysis, Random Processes.

Docs- Dept of Florida, state depository June 8 1972

Doty, K.L. (Assistant Professor) Ph.D. (University of California, Berkeley) Switching Theory, Small Computer Architecture, Automata.

Dove, D.B. (Associate Professor) Ph.D. (University of London) Electrical and Structural Properties of Thin Films, Magnetic Films, Semiconducting Films, Electron Diffraction.

Durling, A.E. (Professor) Ph.D. (Syracuse University) Computational Techniques and Systems Theory.

Elgerd, O.I. (Professor) D.Sc. (Washington University, St. Louis) Electric Energy Systems Theory, Control Theory and Practice.

Forsman, M.E. (Professor and Director of Engineering External Programs) Ph.D. (Iowa State) Power Systems, Nuclear Reactors.

George, T.S. (Professor) Ph.D. (Duke University) Statistical Theory of Communications, System Analysis and Engineering, Operations Analysis.

Harden, R.C. (Professor) (Resident Director - GENESYS - Orlando) Ph.D. (University of Florida).

Johnson, R.C. (Professor) M.S.E. (University of Florida) Communications Systems, Detection Theory and Systems Analysis.

Jones, L.E. (Assistant Professor) Ph.D. (Purdue University) Control Theory, Adaptive and Learning Systems.

Kaiser, W.F. (Assistant Professor) M.B.A. (University of Chicago) Basic Electrical Engineering, Creative Problem Solving.

Karacan, I. (Associate Professor) M.D. (Istanbul) Psychiatry, Biological Systems, Sleep Research.

Latour, M.H. (Associate Professor) M.S.E. (University of Florida) Waves and Fields, Radio Wave Propagation, Microwaves, Radar Meteorology.

Li, S.S. (Assistant Professor) Ph.D. (Rice University) Semiconductor Electronics, Electronic Transport and Recombination Properties in Semiconductor Materials and Devices, Photoelectric Effects in Semiconductors.

Lindholm, F.A. (Professor) Ph.D. (University of Arizona) Solid-State Device Theory and Modeling, Integrated Circuits.

Lipovski, G.J. (Assistant Professor) Ph.D. (University of Illinois) Computer Architecture, Automata Theory.

Manders, A.M. (Associate Professor) Ph.D. (Electrical Engineering) (Polytechnic Institute of Brooklyn) Communication Systems.

Nevis, A.H. (Associate Professor) M.D. (Harvard University) Ph.D. (Massachusetts Institute of Technology) Biomedical Systems.

Nickelson, W.R.D. (Assistant Professor) B.S.E. (U.S. Naval Academy).

O'Malley, J.R. (Associate Professor) Ph.D. (University of Florida) Computer Science and Circuits.

Paige, A. (Associate Professor) Ph.D. (University of California) Mechanical Speech Processing.

Priem, E.S. (Assistant Professor) B.S.E.E. (Milwaukee School of Engineering) Electric Energy Engineering, Creative Problem Solving.

Ramey, R.A. (Professor) D.Sc. (University of Cincinnati) Magnetics, Computer and Information Science, Creativity.

Rosier, N.E. (Associate Professor) M.S.E. (University of Florida) Radar and Television, Microelectronics.

Sah, C.T. (Lecturer) Ph.D. (Stanford University) Physical Electronics, Semiconductor Device Theory.

Sashoff, S.P. (Professor) M.S. (University of Pittsburgh) Electronics.

Schoonmaker, L.E. (Emeritus).

Shaffer, C.V. (Professor and Assistant Dean of the Graduate School) Ph.D. (Electrical Engineering) (Stanford University) Network and Systems Science.

Simons, F.O. (Associate Professor) Ph.D. (University of Florida) Electromagnetic Field Theory, Control Theory, Analog-Hybrid Computers.

Smallwood, M.H. (Assistant Professor) M.S.E. (University of Florida) Electrical Machinery, Power Generation and Distribution.

Smith, E.F. (Associate Professor) B.S.E.E. and E.E. (University of Florida) Electrical Energy Engineering.

Smith, J.R. (Professor) Ph.D. (University of Southern California) Biomedical Engineering, Control.

Su, S.Y. (Assistant Professor) Ph.D. (University of Wisconsin) Programming Languages, Computer Linguistics.

Sullivan, R.L. (Assistant Professor) Ph.D. (University of Florida) Energy Systems and Control.

Sutherland, A.D. (Professor) Ph.D. (University of Illinois) Microwave Networks, Solid-State Microwave Devices, Wave Propagation in Plasmas.

Teas, D.C. (Associate Professor) Ph.D. (Texas) Evoked Response, Auditory Electro Physiology.

Tou, J.T. (Graduate Research Professor) Ph.D. (Yale University) Computer, Control and Information Science (Pattern Recognition, Software Engineering, Information Retrieval, Picture Processing).

van der Ziel, A. (Graduate Research Professor) Ph.D. (University of Groningen) Noise and Solid-State Devices.

Walker, R.L. (Professor - Resident Director GENESYS - Port Canaveral) Ph.D. (Stanford University).

Walter, W.A. (Associate Professor - GENESYS - Daytona Beach) Ph.D. (University of Florida) Circuit Theory, Automatic Control, Sensitivity Theory and Hybrid Computation.

Ward, G.D. (Assistant Professor) Ph.D. (Maryland) Plasma Physics, Atmospheric Sciences.

Watson, J.K. (Associate Professor) Ph.D. (Rice University) Magnetism (Especially Digital Computer Memory Applications), Memory Materials and Systems, Digital Logic.

Weil, J. (Emeritus).

Wheeler, L.A. (Associate Professor) Ph.D. (University of Southern California) Control Theory, Computer Design and Systems Analysis.

Wing, A.H. (Professor) Ph.D. (Columbia University) Transistor Electronics.

Yii, Roland (Professor) Ph.D. (University of Pennsylvania) Computer Design, Circuits and Electronics.

Zahn, M.D. (Assistant Professor) D.Sc. (Massachusetts Institute of Technology) Electromechanical Dynamics, Energy Conversion.

Zetrouer, W.F. (Assistant Professor) M.S.E. (University of Florida) Electronic Circuitry.

INTRODUCTION

The Electrical Engineering Program at the University of Florida is one of the oldest programs in the College of Engineering at the university. It was initiated with the establishment of the university at Gainesville in 1905. The first class to receive bachelor degrees in engineering from the university included four electrical engineers. The program has experienced continuous growth since that date. As of September 1970 a total of 2734 Bachelor of Science Degrees in Electrical Engineering had been awarded. This represents 35 per cent of the total engineering bachelor degrees awarded by the College of Engineering at the University of Florida. The department has a similiarly large graduate program that had awarded 297 Engineering degrees, 97 Master of Science degrees and 3 Engineer degrees and 75 Ph.D. degrees as of September 1970.

The Department of Electrical Engineering has been recognized as a leader in the Southern United States for many years. The program has been fully accredited continuously by the Engineering Council of Professional Development (ECPI) since 1937 when the practice of accreditation was initiated by them. Prior to 1937, the department received its accreditation from the University System of the State of New York Accreditations Board.

The department is now recognized as a leading institution on the national scene. The American Council of Education Report of 1970 lists the Rated Quality of Graduate Faculty of the department in the top category, "Distinguished and Strong." This is the first time that an engineering department of any university located in the Southeastern United States has received this high recognition. This rating applies to the graduate faculty and no similiar rating system exists for undergraduate faculty. The undergraduate faculty and the graduate faculty are the same people in this department.

One of the most significant events effecting Electrical Engineering at the University of Florida during recent time was the construction of two new buildings specifically for Electrical Engineering in the late 1960's. These new buildings allowed for the inclusion of modern well-equipped laboratories for the Undergraduate Teaching Program. The undergraduate student also has access to several highly specialized research laboratories constructed in these facilities. The Microelectronics Research Laboratory contains the complete facilities required to fabricate integrated circuits. The undergraduate students enrolled in EE 523, 527, 528 or 529 utilize these facilities to make solid-state components such as transistors and complete monolithic integrated circuits.

There are other highly specialized laboratories such as the Direct Energy Conversion Laboratory and Microwave Devices Laboratory that are also utilized in the Undergraduate Teaching Program.

The Electrical Engineering Curriculum is designed with enough flexibility to allow the student to commence his area of specialization during his undergraduate program. The plan of study may be tailored to fit the individual. Undergraduate students should consult their counselor and the various option advisors early in their program to take maximum advantage of this flexibility.

Qualifications for Admission

To qualify for admission to the College of Engineering, Department of Electrical Engineering, a student will normally have 96 quarter hours of college credit, with at least a 2.00 average (or an Associate of Arts degree from a junior college). It is highly desirable, but not essential, that this college credit be pre-engineering. The credit may be earned at the University of Florida, a junior college, at another university, or at more than one accredited institution. A minimum of 89 quarter hour credits are designated as Lower Division (LD) work, and would normally be obtained at the University of Florida while in University College. After being admitted to the College of Engineering, Department of Electrical Engineering, the student is in Upper Division (UD).

Many engineering students have decided upon a career in the engineering field before they leave high school and complete the pre-engineering requirements in the first 96 quarter hours. Others change to engineering after they begin their college work, and enter UD without the necessary LD pre-engineering requirements. Any student who considers shifting toward a career in electrical engineering after he has started some other area, should consult the counselor in the Department of Electrical Engineering.

What is Electrical Engineering?

Electrical Engineering is based upon the fundamental scientific discovery of electromagnetism. This discipline is a science-oriented branch of engineering primarily concerned with all phases and development of the transmission of power and intelligence.

The application and development of electrical phenomena, based upon magnetic induction, has made possible the amazing developments and uses of the wondrous devices we enjoy today.

Developments and applications by electrical engineers in such areas as computer science, power, systems science and electronics have made possible our space travel, landings on the moon, computer technology, radar, cardiac pacemakers and artificial limbs, just to name a few of the wonders resulting from the developments in the transmission of power and intelligence. The electrical engineer is the individual who develops new ways to use electrical energy.

How to become an Electrical Engineer

High School Preparation:

An electrical engineer is science-oriented. A boy or girl interested in this field should concentrate on science-oriented courses. Mathematics is important because it teaches how to analyze problems and think in an orderly manner. It is one of the basic tools required by an electrical engineer.

Physics and chemistry are fundamental engineering courses. They provide basic knowledge of natural phenomena and materials. Besides providing scientific knowledge, the student is introduced into problem-solving and experimental techniques.

It is extremely important that a student acquire the knowledge to express his thoughts correctly both in oral and written communications. In order to round out a student's knowledge, other courses in humanities, history, economics or similar coverage will be most beneficial.

Suggested High School Outline:

Algebra	2 units
Geometry	1 unit
Trigonometry	1 unit
English	4 units
Chemistry	1 unit
Physics	1 unit
Social Studies	2 units
Others	4 units

Junior College Preparation:

Many of Florida's junior colleges, in cooperation with the College of Engineering, have developed college-parallel programs which comprise the first two years of an engineering college program at the University of Florida.

If, upon graduation from high school, you attend a junior college, you should complete the following courses among others which may be required by the college to earn an Associate of Arts degree:

Subject	*Semester Hours*
1. Social Science	6
2. English	6
3. Humanities	6 to 8
4. Engineering Drawing	2
5. Chemistry through Quantitative Analysis	8
6. Engineering Physics with Laboratory (taught with calculus)	8
7. Mathematics through Differential Equations	15

If Engineering Mechanics and Digital Computer Programming (Fortran) are among the course offerings that can be applied to your Associate of Arts degree, these credits (within the total of 96 quarter hour equivalents that are authorized for transfer from a junior college) may be transferred and used to offset upper division requirements at University of Florida.

You are urged to visit the campus during this period and discuss your work with the electrical engineering advisors. The University of Florida will accept the most desirable 64 semester (96 quarter) hours with the grade "C" or better.

Preparation in Electrical Engineering at the University of Florida, University College

Those students entering the university directly from high school will, during the first two years, take essentially the same courses as in the junior college, plus possible additions. During this period the student is expected to obtain a foundation in mathematics, physics and chemistry, engineering graphics, computer programming and an introduction to electrical engineering. Further, where it is possible to schedule the course, the student should include engineering mechanics during this period. These technical foundation courses are interlaced with a sequence of Lower Division "core" courses which provide a basic understanding of American Institutions, English and Humanities. In addition, a student has an opportunity to follow his natural interest in other areas. Engineering advisors are available for guidance during this period. The specific course requirements are listed on the next page.

Courses	*Quarter Hour Credit*
CSS 111, 112, 113 - American Institutions	9
CEH 131, 132, 133 - Comprehensive English	9
CHN 251, 252, 253 - The Humanities	12
EGC 180 - Engineering Concepts & Studies	1
CY 211, 212, 213 - General Chemistry and Qualitative Analysis	12
MS 301, 302, 303, 304 - Analytic Geometry and Calculus	20
MS 305 - Elementary Differential Equations	3
PS 215, 216, 217 - General Physics with Calculus	9
PS 225, 226, 227 - Physics Laboratory	3
*ISE 350 - Digital Computer Programming	2
Physical Education	3
*EE 301 - Intro. to Electrical Engineering	5
EGR 183 - Elementary Engineering Graphics	2
Lower Division Elective	6
TOTAL CREDITS NORMALLY EARNED PRIOR TO ADMISSION TO UPPER DIVISION	96

*Upper Division Credits

Electrical Engineering Program of Study

The program to be followed prior to entrance into the Upper Division (UD) at the University of Florida was previously discussed and the basic parameters laid out. Depending upon the institution or institutions at which this portion of the student's education was acquired, there will be numerous required variations in the program of study after the student is accepted into the UD.

Listed below are the current requirements for work in the UD to earn a Bachelor of Science degree in Electrical Engineering:

ESM 304 - Engineering Mechanics I	5
ESM 305 - Engineering Mechanics II	5
ISE 350 - Digital Computer Programming	2
ME 360 - Thermodynamics	5
MS or STA - Approved Mathematics or Statistics Elective	3
EE 301 - Introduction to Electrical Engineering	5
EE 320 - EE Laboratory I	1

EE 340 - EE Laboratory 2	1
EE 420 - EE Laboratory 3	1
EE 430 - EE Laboratory 4	1
EE 440 - EE Laboratory 5	1
EE 450 - EE Laboratory 6	1
EE 321 - Electronics 1	3
EE 322 - Electronics 2	5
EE 331 - Circuits 1	3
EE 332 - Circuits 2	3
EE 333 - Circuits 3	3
EE 352 - Electromagnetic Fields 1	4
EE 353 - Electromagnetic Fields 2	3
EE 361 - Introduction to Computer Systems	4
EE 381 - Elements of Electrical Energy Engineering 1	3
EE 382 - Elements of Electrical Energy Engineering 2	3
EE 441 - Communication Systems and Components	4
EE 474 - Linear Control Systems	3
EE 491 - Creative Problem Solving	3
TOTAL	75 credits

In addition to the so-called Electrical Engineering "core" subjects required to be taken by all electrical engineering students (minor exception for those choosing Biomedical Option), it is required that each student complete work for nine quarter hour credits in some non-technical subjects and 29 quarter hour credits in additional technical subjects. An individual is afforded broad latitude in selecting courses to fulfill the requirement for nine hours of non-technical material. Practically any lecture course at the university at the "200" level or above which does not bear directly on the technical aspects of the students primary area of study may be selected. The student will be guided in the selection of the additional technical subjects by the requirements of the particular option he elects to pursue within the broad field of electrical engineering. (Further on in this pamphlet these several optional fields are described along with the technical subjects required in order to satisfy the option for graduation). Each graduating student must have satisfied the requirements of one of the optional fields.

Students who enter the upper division from University of Florida's University College may have taken several of the "core" subjects prior to admittance to UD. In certain cases students admitted from a junior college, other college or university may have completed some subjects that can be evaluated as creditable against Upper Division requirements.

Planning a Program of Study

The following possible course sequences are included to provide a general guide.

Possible Course Sequences for those Attending University College (University of Florida)

1st Quarter

MS 301	Analytic Geometry & Calculus	5
CSS 111	American Institutions	3
CEH 131	Comprehensive English	3
EGC 180	Engr. Concepts & Studies	1
CY 211	General Chemistry	4
PHA	Physical Education	1
	Hours	17

2nd Quarter

MS 302	Analytic Geometry & Calculus	5
CSS 112	American Institutions	3
CEH 132	Comprehensive English	3
CY 212	Gen'l Chemistry & Qual. Anal.	4
PHA	Physical Education	1
	Hours	16

3rd Quarter

MS 303	Analytic Geometry & Calc.	5
CSS 113	American Institutions	3
CEH 133	Comprehensive English	3
CY 213	Gen'l Chemistry & Qual. Anal.	4
PHA	Physical Education	1
	Hours	16

4th Quarter

MS 304	Analytic Geometry & Calc.	5
CHN 251	The Humanities	4

ISE 350	Digital Compt. Progm. (UD)	2
PS 215	Gen'l Physics with Calculus	3
PS 225	Physics Laboratory	1
	Hours	15

5th Quarter

MS 305	Element. Differen. Equa.	3
CHN 252	The Humanities	4
PS 216	Gen'l Physics with Calculus	3
PS 226	Physics Laboratory	1
EGR 183	Elem. Engr. Graphics	2
Elective		3
	Hours	16

6th Quarter

EE 301	Electrical Engineering (UD)	5
CHN 253	The Humanities	4
PS 217	Gen'l Physics with Calculus	3
PS 227	Physics Laboratory	1
Elective		3
	Hours	16

ENTER UPPER DIVISION

It is not necessary to complete 100% of the above program prior to admittance to the College of Engineering. In addition to the 2.00 grade point average, a student must satisfy the General Education Requirements which consist of the above CSS, CEH, and CHN courses. It is desirable, but not strictly necessary, that all of the CY, MS and PS courses be completed. If the student is attending junior college or another university, it is particularly advisable to complete CY, MS and PS there, since the change from the sequence at one institution to that existing at another institution is difficult in these particular courses.

EE Upper Division Suggested Course Sequence University College Transfers

1st Quarter

EE 320	Electrical Laboratory 1	1
EE 321	Electronics 1	3
EE 331	Circuits 1	3

EE 361	Intro. to Computer Sys.	4
ESM 304	Engineering Mechanics 1	5
	Hours	16

2nd Quarter

EE 322	Electronics 2	5
EE 340	Electrical Laboratory 2	1
EE 332	Circuits 2	3
ESM 305	Engineering Mechanics 2	5
or		
MTL 310	Elec. Properties of Materials	4
MS or STA Elective		3
	Hours	16 or 17

3rd Quarter

EE 333	Circuits 3	3
EE 420	Electrical Laboratories 3	1
EE 352	Electromagnetic Fields 1	4
ME 360	Thermodynamics	5
EE 381	Elem. of Elec. Energy Engr. 1	3
	Hours	16

4th Quarter

EE 353	Electromagnetic Fields 2	3
EE 382	Elem. of Elec. Energy Engr. 2	3
EE 430	Electrical Laboratory 4	1
EE 441	Communications Sys. & Comp.	4
Non-Technical Elective		5
	Hours	16

5th Quarter

EE 440	Electrical Laboratory 5	1
EE 474	Linear Control Systems	3
Tech. and Non-Tech. Electives		12
	Hours	16

6th Quarter

EE 450	Electrical Laboratory 6	1

EE 491	Creative Problem Solving	3
Tech. and Non-Tech. Electives		12
	Hours	16

7th Quarter

Tech. and Non-Tech. Electives 9 or 10 hours

EE Upper Division Suggested Courses Sequence Junior College Transfers

(Assumption made that student had completed requirements for chemistry, physics, social science, English, humanities, engineering drawing, mathematics through differential equations prior to admittance to College of Engineering.)

1st Quarter

EE 301	Intro. to Electrical Engr.	5
ISE 350	Digital Computer Programming	2
ESM 304	Engineering Mechanics 1	5
MS or STA or Non-Tech. Elective		3
	Hours	15

2nd Quarter

EE 320	Electrical Laboratory 1	1
EE 321	Electronics 1	3
EE 331	Circuits 1	3
EE 361	Intro. to Computer Systems	4
ESM 305	Engineering Mechanics 2	5
or		
MTL 310	Elec. Properties of Materials	4
	Hours	15 or 16

3rd Quarter

EE 322	Electronics 2	5
EE 340	Electrical Laboratory 2	1
EE 332	Circuits 2	3
EE 352	Electromagnetic Fields 1	4
MS or STA or Non-Tech. Elective		3
	Hours	16

4th Quarter

EE 333	Circuits 3	3
EE 420	Electrical Laboratory 3	1
EE 353	Electromagnetic Fields 2	3
ME 360	Thermodynamics	5
EE 381	Elem. of Elec. Energy Engr. 1	3
	Hours	15

5th Quarter

EE 382	Elem. of Elec. Energy Engr. 2	3
EE 430	Electrical Laboratory 4	1
EE 441	Communications Sys. & Comp.	4
Tech. or Non-Tech. Elective		
	Hours	9
		17

6th Quarter

EE 440	Electrical Laboratory 5	1
EE 474	Linear Control Systems	3
Tech. or Non-Tech. Electives		15
	Hours	18

7th Quarter

EE 450	Electrical Laboratory 6	1
EE 491	Creative Problem Solving	3
Tech. or Non-Tech. Electives		12 or 13
	Hours	16 or 17

Note:
Course loads during sixth and seventh quarters are moderately heavy. Some students may desire to attend an additional quarter to permit lighter course loads.

The Electrical Engineering Option Program

A few years ago the electrical engineering student at the University of Florida had two options from which to choose; communications (vacuum tubes) or power (rotating machinery). Many graduates were able to take all the undergraduate courses offered. Currently, six areas of specialization are offered and this number may increase in the future. This specialization may be continued to the Ph.D. level. At present it would be impractical for a student to consider taking all or even most of the undergraduate electrical engineering courses. In the following paragraphs the six optional areas of the electrical engineering program are described in some detail.

Biomedical Engineering Option

What is Biomedical Engineering? It is the discipline concerned with the application of mathematics, physical sciences and computer technology to the solution of biological and medical problems. The biomedical engineer must acquire special education, training and experience to be able to plan, design or supervise construction and continuing utilization of systems, equipment and techniques for solving biological and medical problems. The goal of the biomedical engineering option in electrical engineering is to provide the opportunity for the student to acquire this special education and experience, which of necessity cuts across the "boundaries" or interfaces of engineering with medicine and biology.

Some of the problems that are specifically studied in this field, include: the application of information-and-control theory (and computer technology) to analysis and detection of the electroencephalogram ("brain waves"), especially in sleep studies and in epilepsy studies; the analysis of electroencephalogram with visual stimuli of various kinds (visual evoked response studies); the use of electric impedance techniques in studying epilepsy and brain edema (water collection in the brain, a common feature of many neurologic disorders); computer analysis and synthesis of speech; the development of special sensors such as brain pressure transducers or tissue temperature transducers, and their application to specific medical research projects (such as the effects of drugs and anesthesia on the brain, or the effects of organometallic poisons in brain); the use of tissue electric impedance to test for the viability of organs (such as the kidney) in organ transplant studies; neuroelectric modeling and data processing in biologic systems; the application of micro electronics and telemetering devices to medical research.

This special education experience prepares the student for work in industry (design and development of special systems), in hospitals, or in research laboratories, as a member or leader of a research team (investigating health problems, or studying basic biologic problems). A unique feature of this option is that its completion not only qualifies the student for a BSEE degree but meets the pre-medical requirements for the University of Florida Medical School. Many of the current graduates are sought out for university academic positions because of the expanding educational needs in this field. With increasing demands in developing solutions to environmental pollution problems there is a growing need for biomedical engineers to work on special projects. This is such a young field, which has had such a great growth in the past few years, that one could truly foresee the present need, not to mention the future need, for biomedical engineers. Advances in technology will continue to breed new demands for applications of biomedical engineering skills to many fields such as marine biology, space flight studies, and preventive health measures.

The individuals who enter biomedical engineering not only need skills for handling mathematical problems, and ability to grasp physical and chemical concepts, but also the ability for pursuing biologic studies and systems analysis. He should enjoy working with people and understanding points of view quite different from his own, because he will frequently be working with people from other professional and technical areas, and with non-scientifically oriented individuals, at times. He should not only be intelligent, but imaginative and flexible in his mental pursuits, so that he can accept and enjoy the challenges of a newly developed and demanding profession.

Specific Course Requirements For Biomedical Engineering Option

A student selecting this option should see his advisor early in the program because the core program for this option is significantly different from other electrical engineering options. Specifically, the following "core" courses are not required: EE 382 (3), ME 360 (5), ESM 304 (5) and ESM 305 (5).

The required courses for this option are:

ESM 301	Statics	4
CHE 333	Cml. Engr. Thermo.	3
Zy 201	Intro. Zoology Lab.	4
ZY 202	Prin. of Animal Bio.	5
ZY	Elective	4
CY 371	Organic Chemistry	3
CY 372	Organic Chemistry	3
CY 373	Organic Chemistry	3
CY 374	Organic Chem. Lab.	1
CY 375	Organic Chem. Lab.	2

An additional 15 hours of required Technical Electives are unspecified but the courses selected are to be approved by the option advisor. Dr. J.R. Smith of the Electrical Engineering Department is the option advisor.

COMMUNICATION THEORY OPTION

The field of communications is one of the most active areas in the world today. The role the engineer plays in this field is to provide the expertise to design, analyze, and devise new methods and systems to communicate or transmit information from one location to another as reliably as possible. But the field of communications is more than this for it includes:

Satellite and Space Communication systems which must be designed and analyzed to accomplish the transmission of photographic data from the Moon or Mars or space probes back to earth. An engineer must provide for reliable voice communication between astronauts and earth control; further he must devise telemetry systems for the transmission of data monitored remotely by super-sensitive transducers. Satellite communications are rapidly expanding to transmit almost instantly news, messages and television programs. Satellites are also being used to provide assistance for tracking and navigational systems.

Signal detection, extraction, and enhancement techniques are constantly being devised and improved upon to assist the engineer in providing the best possible system at the least cost. Radar and sonar systems are typical examples which use the most up to date methods in this area.

Noise control, analysis, characterization, and elimination are under constant investigation both experimentally and theoretically. This problem is really one of pollution and ultimately limits what we hear, see, and feel, for example thermal pollution. The communication engineer's function is to find ways to suppress the noise at the minimum cost for the maximum benefit of society.

Signal modulation principles such as amplitude, phase, and frequency are utilized to improve data transmission capabilities.

Antenna design and propagation techniques are necessary elements of an overall communication system. The engineer is responsible for designing systems which do not interfere with existing systems, e.g. AM and FM radio stations.

Microelectronics principles are now incorporated in all the latest system developments. Thus micro-miniaturization of systems is here.

Lasers are a communication media not only for the future but of the present. Their use is being investigated by NASA, the telephone utilities, industry, and the government. They are being utilized in the most advanced computers being designed for tomorrows users. The systems of the future will convey digital data by the light beams of lasers via synchronous satellites.

The above areas are by no means all inclusive. For the principles learned by the communications scientist, theoretician, or engineer allow him to make contributions to such fields as physiology where the communications systems of the body are studied. He is now called upon to improve our underwater communication techniques so that we may travel and communicate freely underwater. These engineers are also called upon to analyze the electrical activity of the heart, the brain, noise in electrical devices, the characteristics of speech, oceanographic and atmospheric data, etc. The latest procedures now call for the design of adaptive (or learning) systems which change their characteristics as the information being transmitted changes.

This field is one the most dynamic and exciting careers available. Its practitioners will mold the future of business, education, industry and government.

Specific Course Requirements for Communications Theory Option

Required courses:	EE 442	Modulation and Communication Systems	3
	EE 443	Noise in Devices and Communication Systems	3

Of the remaining 23 hours of required technical electives, the student must select 15-17 hours from:

EE 522	Transistor Electronics	3
EE 524	Pulse Circuits Lab.	1
EE 525	Pulse Circuits	3
EE 527	Integrated Circuits	4
EE 551	Antenna Systems	3
EE 556	Microwave Techniques	4
EE 561	Digital Computer Prin. 1	4
EE 562	Digital Computer Prin. 2	4
EE 600	Elements of Linear Systems	3
EE 640	Noise in Linear Systems	3
EE 651	Electromagnetic Flds. & Waves	3
MS 503	Intro. to Complex Var. Engr. & Sci. 1	3
MS 504	Intro. to Complex Var. Engr. & Sci. 2	3
STA 440	Mathematical Statistics 1	3
STA 441	Mathematical Statistics 2	3
STA 442	Mathematical Statistics 3	3

The other 6-8 hours must be selected from either the list or from MS, STA, PS, EE, or other Engineering Department offerings. Dr. D.G. Childers of the Electrical Engineering Department is the option advisor.

COMPUTER SCIENCE

The computer science option encompasses a large range of subject matter that is principally related to digital computers. Provision is made for students having either hardware or software interests and who are either abstractly or practically inclined.

In the hardware courses, which relate to digital computer components, students study the details of the circuits used in digital computers and construct some of these circuits. They learn design procedures involving Boolean Algebra for interconnecting these circuits. And, they consider the major components of digital computers in some detail; these are the arithmetic unit, the memory, the control unit, and the input-output unit. These courses offer an approach to digital computer study that is especially attractive to students who are practically inclined. These students construct a digital computer starting with basic components.

The Department of Electrical Engineering has a software course which surveys the software field. The term software refers to the non-hardware aspects of digital computers such as the programs that are used to direct digital computer operations. Some other software courses are available in the Engineering College. Sufficient elective hours are provided in the computer science option to enable students to take all the software courses available to undergraduates.

For those students interested in the use of computers for solving scientific problems, there are courses in numerical techniques available. All electrical engineering students are required to take a course in numerical techniques. If a student desires to specialize in this field, he can do individual work, for course credit, with one of the electrical engineering professors specializing in numerical techniques.

Courses are also available covering analog computers and their use with digital computers. These combinations are known as hybrid computers.

If a student expresses interest in specializing in a particular aspect of computer science such as software, he can, with permission of the computer science advisor, deviate from the required courses and follow a program in computer science that is tailored to his specific interest.

If a student desires to continue with his computer science work beyond the bachelor's level, he can specialize in either the hardware or software aspects of computer science through the doctoral level. Numerous graduate computer science courses and opportunities for research in computer science are available in the Department of Electrical Engineering.

Specific Course Requirements for Computer Science Option

Required courses:

EE 524	Pulse Circuits Lab	1
EE 525	Pulse Circuits	3
EE 561	Digital Computer Prin. 1	4
EE 562	Digital Computer Prin. 2	4
EE 563	Digital Computer Prin. 3	4

Of the remaining thirteen hours of required technical electives, six hours are unspecified; the other seven hours should be taken from the following list:

Strongly Recommended Electives

EE 527	Integrated Circuits	4
EE 558	Applications of Magnetism	3

Acceptable Electives

EE 522	Transistor Electronics	3
EE 523	Transistor Electronics Lab	1
EE 526	Appl. of Pulse Circuits	3
EE 570	Control Sys. Theory & Prac.	3
EE 571	Synth. of Linear Controls	3
ISE 352	Process Cont. Compt. Progm.	1
ISE 357	Analog Comp. Principles	2
ISE 551	Digital Comp. Techniques 1	3
ISE 558	Hybrid Computer Techniques	3
MS 410	Num. Meth. in Linear Algebra	4
MS 411	Num. Meth. in Analysis	4
MS 431	Survey of Modern Algebra	3
MS 432	Survey of Modern Algebra 2	3
MS 433	Survey of Modern Algebra 3	3
MS 501	Intermediate Diff. Equations	3
MS 502	Vector Analysis	3
MS 503	Intro. to Complex Variables	3
MS 504	Intro. to Complex Variables 2	3
STA 330	Engineering Statistics	3
STA 440	Math. Statistics 1	3
STA 441	Math. Statistics 2	3
STA 520	Statistical Methods in Res.	3

EGC 321	Data Structures	4
EGC 322	Programming Languages	4
EGC 323	Algorithms Of Numerical Calculus	4
EGC 324	Intr. To Information Sciences	4
EGC 331	Storage Structures & Techniques	4
EGC 332	Anatomy Of A Computer	4

Dr. J.R. O'Malley of the Department of Electrical Engineering is the option advisor.

ELECTRIC ENERGY ENGINEERING OPTION

The electric energy engineering option concerns itself with the generation, transmission, distribution and use of electric energy in large quantities.

This option gives the student an opportunity to study electric utility systems, design of the newer energy conversion systems and equipment; namely in direct energy conversion, magneto-hydro dynamics, nuclear energy systems. The study includes application of these systems on earth or in space. It also goes into the design of drive systems and their control. It also goes into the study of industrial, commercial and residential systems and equipment.

This option is available for graduate study through the doctoral level. There is opportunity to do this advanced study by a joint industry-university arrangement.

Specific Course Requirements for Electrical Energy Engineering Option
Required courses:

EE 483	Electric Energy Systems 1	3
EE 484	Electric Energy Systems 2	3
EGC 550	Direct Energy Conversion Engr. 1	3
*Unified Theory of Electrical Machines 1 or *Electromechanical Energy Conversion 1		3

Six of the remaining seventeen hours of required technical electives are unspecified. The other eleven hours must be selected from the following list:

EE 485	Electric Energy Sys. 3	3
*Electric Energy Distribution Sys.		3
EE 524	Pulse Circuit Lab	1
EE 525	Pulse Circuits	3
EE 558	Application of Magnetism	3
EE 561	Digital Computer Prin. 1	4
EE 562	Digital Computer Prin. 2	4

EE 570	Control Sys. Theory & Prac.	3
EE 571	Synth. of Linear Control	3
EE 581	Elec. Energy Sys. Instr.	3
*Unified Theory of Elec. Machines 2		3
*Electromechanical Energy Conversion 2		3
ME 470	Solar Energy	3
MS 501	Intermediate Diff. Equation	3
MS 503	Intro. to Complex Variables 1	3
MS 504	Intro. to Complex Variables 2	3
EGC 551	Direct Energy Conv. Engr. 2	3
EGC 552	Direct Energy Conv. Engr. Lab	1 to 3
NES 401	Intro. to Nuclear Engr. 1	4
NES 402	Intro. to Nuclear Engr. 2	4
NES 403	Intro. to Nuclear Engr. 3	4
NES 551	Nuclear Power Reactors 1	4

*Course number to be established.

Dr. O.I. Elgerd of the Department of Electrical Engineering is the option advisor.

ELECTRONICS OPTION

Electronics is the branch of Electrical Engineering which made possible such modern developments as large scale digital computers, nearly instantaneous world-wide communication, and automatic control of huge systems.

Electronics deals chiefly with the flow of current carriers passing through transistors, diodes, vacuum tubes, gas-filled tubes and other devices. Without these electronic devices, television, radar, radio, and electronic computers would not work.

Most of electronics consists of the science or art of using transistors, vacuum tubes, and other devices to control small electric signals.

The purpose of the electronics option is to provide the basic scientific education required to understand the operation of electronic devices and training in some of the fundamental applications. There is considerable emphasis on the physics involved in the operation of the various devices which exist today. The purpose of this is two-fold. First, an engineer planning to use an existing device can exploit it more completely if he thoroughly understands the physical limitations inherent in its operation. Second, he can contribute to the development of improved devices and even to the invention of devices as yet unimagined if he thoroughly understands the interactions of current carriers and electronic and magnetic fields in various media.

The courses provided in this option cover the spectrum from fundamental device physics to sophisticated applications. It is possible for the individual student to tailor a program which emphasizes his interests.

Specific Course Requirements for Electronics Option
Required Courses:

EE 522	Transistor Electronics	3
EE 523	Transistor Electronics Lab	1
EE 528	Phys. Elect. for Engineers 1	4
EE 529	Phys. Elect. for Engineers 2	4
MTL 310	Elect. Properties of Mat. or	4
MTL 300	Materials 1	

Six of the remaining thirteen hours of required technical electives are unspecified and the other seven must be chosen from the following list:

EE 442	Modulation and Commun. Sys.	3
EE 443	Noise in Devices & Comm. Sys.	3
EE 524	Pulse Circuits Lab.	1
EE 525	Pulse Circuits	3
EE 526	Appl. of Pulse Circuits	3
EE 527	Integrated Circuits	4
EE 551	Antenna Systems	3
EE 555	Microwave Lab	1
EE 556	Microwave Techniques	4
EE 558	Appl. of Magnetism	3
EE 561	Digital Computer Prin. 1	4
EE 562	Digital Computer Prin. 2	4
MS 501	Intermediate Diff. Equations	3
MS 503	Intro. to Complex Variables 1	3
MS 504	Intro. to Complex Variables 2	3
MTL 510	Electronic Structure of Matter	3
PS 340	Modern Physics 1	3
PS 440	Modern Physics 2	3
PS 550	Intro. Solid-State Physics	3
EGC 550	Direct Energy Conv. Engr. 1	3

Students interested in the electronics option are requested to see Dr. E.R. Chenette as early as possible for assignment to an "Electronics Option Advisor." The idea is to make early counseling available to plan an optimum program for the technical elective subjects. The exact program for each student will be tailored as closely as possible to his individual interests.

THE SYSTEMS OPTION

The Systems Option in the Electrical Engineering undergraduate program is a flexible one to accommodate those students who are more interested in the analysis and design of "systems" – large aggregates of "components" – than in the microscopic study of the components themselves. There are many kinds of systems - control systems, electronic circuits, electric power networks, telephone switching networks, radio and television communication systems, computer systems, biological systems, economic systems, cybernetic systems, social systems, transportation systems, for example - and many of these are the subjects of other options. However, new systems are continuously becoming important to industry and society, and those sufficiently skilled in general systems analysis are best equipped to cope with these new fields. Within technological industries, the systems of yesterday (e.g. an electronic circuit containing a dozen or so transistors) are the components today (integrated circuits) in still more complex systems; consequently "systems designers" are tending to replace "circuit designers" in many applications.

The core of the undergraduate systems option is a group of courses which are required of all electrical engineering students, attesting to the close integration of the systems approach with electrical engineering pursuits. These include EE 331 - 332 - 333, EE 361, EE 474, and others. For the systems option only EE 570-571 are specifically required in addition. The remainder of the technical elective credits may be earned in approved system-oriented courses in electrical engineering or in other departments.

Mathematics and statistics are the principal tools of systems analysis and design, and the student should seek an understanding of the basic principles of differential equations, linear transforms, linear algebra, and elementary statistics (with calculus).

Most students in the systems option should aspire to eventual graduate study, and the option is the obvious preparation for a graduate major in Control Systems or Network Theory. Seniors are encouraged to enroll in EE 600, EE 630, and/or EE 640, and credits earned in these courses can be applied toward a University of Florida MS or MSE degree, providing they are in excess of the minimum requirements for the BSEE degree.

Specific Course Requirements For Systems Option

Required Courses:

EE 570	Control System Theory and Practice	3
EE 571	Synthesis of Linear Controls	3

Six of the remaining 23 hours are unspecified. The other 17 hours of technical electives must be selected from the following courses:

EE 442	Mod. & Comm. Systems	3
EE 443	Noise & Devices in Comm. Sys.	3
EE 561	Digital Computer Princ. 1	4
EE 562	Digital Computer Princ. 2	4
EE 600	Elements of Linear Sys.	3
EE 630	Adv. Circuit Analysis	3
EE 640	Intro. to Matrix Theory	3
EE 640	Noise in Linear Systems	3
MS 324	Intro. to Matrix Theory	3
MS 325	Intro. to Abstract Algebra	3
MS 410	Num. Meth. in Linear Algebra	3
MS 411	Num. Meth. in Analysis	3
MS 501	Intermediate Diff. Equations	3
MS 503	Intro. to Complex Variables 1	3
MS 504	Intro. to Complex Variables 2	3
ISE 401	Matrix Meth. in Sys. Engr.	3
STA 440	Mathematical Statistics 1	3
STA 441	Mathematical Statistics 2	3

Dr. C.V. Shaffer of the Department of Electrical Engineering is the Systems Option Advisor.

What does an Electrical Engineer do?

He will be busy extending the influence of the electron ever deeper into our lives. He will be employed by government, industry or education in such areas as: microwaves; field theory; plasmas; integrated circuits; microelectronics; solid-state electronics; control systems; communication systems; biomedical systems; network theory; machinery; energy conversion; power and control; digital, analog, and hybrid computers; simulation; information theory; coding theory; and many other areas.

Electrical Engineering is expanding in theory until it now includes within its domain nearly the whole of physics; and in practice it is expanding the age of electricity.

Opportunities for the Electrical Engineer

The opportunities for the electrical engineer are practically without limit. Opportunity means different things to different people and what appeals to some as an opportunity may be looked on as no opportunity at all to others. However, there is such a variety of jobs where an electrical engineer can use his education and talents that it is fair to say that opportunity abounds for all.

Many consider a teaching assignment the finest type of opportunity even though the monetary compensation may be much less than that available in numerous other fields. Opportunity lies where you enjoy your work and in such an activity you are likely to make greater contributions.

In our present expanding technical society the electrical engineer is broadly recognized as a skilled professional person. In most jobs his pay compares favorably with that of other professional people and from his ranks many are chosen for managment jobs and some advance to the highest positions in education, government and industry. Positions for electrical engineers exist in all geographical areas providing the job seeker with wide choices of environments. Jobs for electrical engineers exist where he will be the only one of his profession employed and in other situations he will work where large numbers of engineers are working for the organization.

An individual who has earned a BSEE degree can reasonably expect to find interesting career opportunities in a variety of activities dispersed throughout many geographical locations and to have a number of possible choices as to where he will start his career.

Counseling Procedure

General Comments

It is the responsibility of each student to assure that the proper records with correct, up-to-date entries are on file in the Department of Electrical Engineering including supporting evidence for all entries, program deviations, petitions, etc.. Your counselor will attempt to assist you by rendering advice but you must be the one to decide on your personal goals and be able to express them in terms of a concrete program within the bounds of the degree requirements. The clerical function of maintaining your records in the department is done by others who depend on you to review and provide the information and documentation to assure completeness and accuracy.

Student Folder

An individual folder is prepared in the Dean's Office for each student at the time he or she is accepted into the Upper Division (UD). This folder will include the transcript furnished by the registrar covering the work completed before admission to the College of Engineering and will be retained in the Department of Electrical Engineering (EE) files. The *student* must make certain that it contains a record of all course work completed. To assure that courses completed at other institutions are included, it is the student's responsibility to cause the transcripts to be sent to the University of Florida. The folder will indicate all Lower Division (LD) deficits at the time of entry into UD and student should take steps to complete this work at an early date. Satisfactory completion of the English Screening Examination should also be recorded in the folder.

Preparation for Counseling

This brochure lists the requirements for graduation and most of the applicable university, Engineering College and department rules and procedures. Prior to formal counseling you should attempt to complete a tentative program that would fulfill the requirements for a degree. This action on your part will prepare you to ask questions and make it easier for you to understand the advice of your counselor during formal counseling.

Formal Counseling

Counseling may be obtained any time during the quarter and it is possible to receive approval for the next quarter plan of study at any time after the start of the preceding quarter. Your counselor has special forms which may be filled out for his signature and held by you to present to the registrar at the time of your pre-registration appointment. This action will eliminate the need for the counselor's signature on your registration card. (The counselor will have a preliminary schedule of electrical engineering and the *required* out-of-department technical courses available early in the preceding quarter so that most potential schedule conflicts will be apparent and can be avoided in making up a student's list of courses).

During the middle of each quarter, formal counseling and preregistration takes place according to an appointment schedule issued by the university. If you have not already secured the signature of your counselor on the special form discussed above you will need to visit him after you have kept your appointment at the registrar's office and picked up your registration card and secure his approval of your course schedule. If you had secured one of the special forms, then you need only appear at the registrar's office at the appointed time, transfer the information to the cards, enter the proper section numbers and complete registration without the necessity of seeing your counselor at that particular time.

If you have not received one of the special forms, you first need to obtain your registration materials from the registrar. Immediately after obtaining the registration forms from the registrar you should go to Benton Hall Room 314 and check out your student folder. To the extent possible you should fill out your registration card and visit your counselor for advice and approval. (During the pre-registration period a counselor will be available in the vicinity of Benton Hall Room 314 and no appointment is required). Those who are registering for the first time in the Department of Electrical Engineering will be photographed at this time and asked to fill out a personal data sheet for the department's use.

Counseling for Option Selection and Graduation

At the time you are ready to select your option field, the requirements of which you must satisfy for graduation, you should visit your counselor. This may be as early as you are ready to decide but needs to take place no later than the time you must schedule the technical electives into your current schedule of courses. You are encouraged to seek information and advice from the option advisor, or from someone he designates, as well as clearing your choice of option with the department undergraduate counselor, if you are uncertain concerning the full implications of this choice. Further, during the quarter prior to the one in which you expect to complete your undergraduate work and qualify for a degree you should visit your department undergraduate counselor for a final check on course completions and minimum requirements for courses to be taken during your final quarter. This latter is for insurance and to eliminate any possible misunderstanding that could result in your failure to meet the requirements for a BSEE.

General Information

Military Science

Six hours of Lower Division (LD) course work is designated for physical fitness, military science and/or electives. The Academic Senate has ruled that, effective September 1970, all entering freshmen must take three credits of physical fitness. Military Science does not satisfy this requirement. Therefore students electing the R.O.T.C. program will be required to take three credits of physical fitness, may use the remaining three credits LD work for R.O.T.C. and will be given credit against total electives for the three credits of R.O.T.C. taken during the second LD year.

Students who enroll in the advanced R.O.T.C. program may not use credit for advanced military science to offset elective requirements. Thus the 202 credit hour program currently in effect becomes a 214 hour program for students electing the advanced Army R.O.T.C. program and a 220 hour program for those electing advanced Air Force R.O.T.C.. Further information regarding specific programs in military science may be obtained by calling the Air Force Office (392-1355) or the Army Office (392-1395).

Change Of Curriculum

It is customary, in the College of Engineering to put a student in the curriculum that is currently in effect at the time he enters UD. If he later desires to switch to a subsequently established program, he must accept the new curriculum totally.

English Screening Examination

This examination should be taken in the student's first quarter in the College of Engineering. It is required of all students including foreign students and students pursuing a second bachelor's degree unless it has previously been taken. It is normally given Tuesday evening of the second week of classes. *It is the student's responsibility to know the exact time and place of the examination.* This information will be announced and posted. If the examination is failed or if the student fails to take the examination, he may have a second chance the following quarter. Failure of this examination results in the student's being required to take EH 302 BASIC TECHNICAL WRITING, 3 credits (or CEH 234, LANGUAGE AND WRITING: FOR FOREIGN STUDENTS, 3 credits). This automatically adds three hours to the requirements for graduation. If the student fails to make a "C" grade, he must repeat the course.

Transfer Credits

Work done at other institutions after admission to the College of Engineering will be credited under "hours earned" but not under "hours attempted" and honor points are disregarded. In other words, transfer credits can not affect a student's honor point average. A course with a "D" will not transfer. The registrar's office will provide a letter to another institution for a student indicating good standing at the University of Florida. It is desirable for a student to receive prior approval from his counselor regarding specific courses to be taken elsewhere. No credit can be transferred from a junior college after a student has earned 96 hours. Therefore no student in the College of Engineering can transfer credit from a junior college. If an engineering student takes a required course at a junior college, he will not have to repeat the same course at the University of Florida but will still have to earn the credit hours.

Withdrawals

If a student, not on probation, withdraws from the university for the first time, his department has the option of excusing this action, or requesting that he be placed on college probation. If he withdraws a second time, regardless of reason, he will automatically be placed on college probation, and this status will continue until graduation. If he withdraws a third time, he will have excluded himself automatically from further registration in the College of Engineering. The intent of this policy is to encourage the student to make normal academic progress.

Petitions

All students have the privilege of petitioning. They should do so with advice and assistance from their counselor. For convenience, the principal types of petitions and the committee empowered to act upon them are summarized as follows:

a. To drop or add a course after the deadline date stipulated in the catalog - The College of Engineering Petitions Committee for Drop, Add and Change of Section. Petitioner should secure forms from Dean's Office, Room 312, Weil Hall. This committee is empowered to authorize drops below the stipulated catalog minimum of 12 hours, if appropriate. The committee considers its principal mission to be the relief of compassionate situations which could not have been foreseen at the beginning of the quarter.

b. To substitute for a required course - the College of Engineering Petitions Committee; Chairman, Prof. John W. Hoover. Secure forms in triplicate from your counselor. The committee will look unfavorably on such a petition if they believe it degrades the curriculum or if it reduces the total number of hours required for the degree. (Note: If the student has been formally designated an "Honor" student, this procedure may be omitted. In such case, the Dean may approve the substitution if recommended formally in writing by your counselor). This same committee is also vested with authority to waive the 45-quarter-hour residence rule in appropriate cases.

c. To graduate short of the required number of hours, short a required course, or with an average below 2.00 - these require the approval of your department faculty, followed by approval of the entire faculty of the College of Engineering at a formal meeting. It should be noted that authority to graduate with an upper division honor point average less than 2.00 is accorded so infrequently as to be practically mythical.

d. Other petitions (principal types described below) - to the College of Engineering Academic Petitions Committee; Chairman, Dean J.A. Nattress. These chiefly embrace the following:

(1) Request for Upper Division sponsorship under the 125-quarter-hour rule: *These require a formal planned program made out by the student indicating that he fully understands its terms. After approval by the Dean's representative, the original will be sent to University College.*

(2) Requests to be readmitted to the university after suspension for disciplinary reasons, or for violation of scholarship or academic probation: *These must be supported, as above, by a planned program. If approved by the College Committee, they must have the further approval of the University Senate Petitions Committee.*

(3) Requests to be permitted to withdraw without receiving all failing grades after the deadline date stipulated in the university calendar: *Same channels as (2) above. To be successful, the petition must be extremely convincing, and has a slim chance unless predicated on a documented compassionate situation which could not have been foreseen.*

Honors and High Honors

To be eligible for the designation of Honor Student in the College of Engineering, a student must have earned a 3.20 or higher average in all work taken in UD, must have been registered in the College of Engineering for at least one quarter, and must have earned at least 16 hours of UD work at the University of Florida. His progress and conduct must be such as to merit the recommendation of his department. So long as the student maintains these qualifications, he will be designated an honor student and may receive special consideration regarding substitution of courses. If he completes all of his required work for his degree with at least a 3.20, he will be graduated with honors.

An honor student may be invited by the Dean to become a candidate for high honors under the following conditions: (1) it is indicated that his final upper division grade point average will be 3.5 or higher; and (2) the faculty of the Department of Electrical Engineering recommends him for invitation to high honors. The invitation is tendered in a letter from the Dean and a written acceptance by the student in a letter reply to the Dean is required. The candidate for high honors must do a high honors project under the direction of a committee composed of two faculty members from the Department of Electrical Engineering, one to serve as chairman, and one faculty member from another department. The student will assist in the selection of the committee which will be appointed by the Dean upon the recommendation of the department chairman. The project title will be recommended and approved in this same correspondence.

The high honors project shall include a thesis or written report to be submitted at the conclusion of the project. The thesis requirement is normally waived for all students whose upper division average is 3.8 or higher. The thesis requirement may be waived for a student with less than 3.8 average with *prior written* approval from the Dean of the College of Engineering. All high honors candidates are normally given an oral comprehensive examination by their committee at the completion of their project work.

Cooperative Education Program

A number of industries, in cooperation with the College of Engineering, have established a cooperative program for engineering education which provides employment in alternate quarters. Students may apply for the co-op program during their freshman year by contacting the Dean's Office. Normally the student will return to school full time for his final year. Acceptance of the student is based upon his academic standing and the availability of co-operative assignments. Under the co-op plan, many students in engineering are able to pay much of their school expenses with money saved while on their work assignments.

Second Bachelor's Degree

Two degrees of the same rank will not be conferred upon the same individual unless the second degree represents at least forty-five credits of work beyond the requirements for the first degree. The exact content of a second Bachelor's degree program in Electrical Engineering must be worked out with a departmental counselor and will nearly always consist of more than the minimum forty-five credits. All necessary residence requirements must also be met.

Grade Point Average

The College of Engineering is concerned with the average a student attains after being admitted to UD. This average is referred to as his UD average. It is based on all UD courses taken at the University of Florida, whether carried in LD or UD, and all LD work taken after being admitted to the UD. The grade point average is not affected by credit transferred from any other institution. Averages are determined by computing the ratio of grade points to quarter hours recorded as "attempted" or carried. Grade points are established by equating each quarter hour grade with points as follows: A with 4, B with 3, C with 2, D with 1, and E, EW, I. WF, U, and X with 0. In computing the average, a course repeated is counted as many times as grades for it are recorded. The UD grade point deficit is the number of additional points needed to attain a 2.0 UD average. For example, a student with 90 grade points from 50 hours attempted has an average of 1.8 (90/50) and a deficit of 10 grade points [(2.0 X 50) - 90].

Financial Aid

Many competitive scholarships are available to engineering students. Scholarship applications should be in a counselor's file to ensure proper consideration when a scholarship becomes available. This is especially true during the summer term when many scholarships are awarded for the following academic year. Experience has shown that an average of 3.5 or higher is generally necessary although financial need plays a substantial role in many scholarships. Therefore, a student with a 3.0 average or better who can demonstrate need should apply. Electrical Engineering counselors and the Dean's Office can provide specific information on most scholarships to be awarded to engineering students. The Dean's Office will also have information regarding some loans and waiver of out-of-state tuition fees. The Student Financial Aid Office is available in Tigert Hall to provide assistance to all students where possible.

Probation and Suspension

Academic probation is intended to: (1) recognize unsatisfactory work at an early date; (2) make the student, his parents, and the administration aware of the shortcomings of the student's performance; (3) provide occasion for counseling, and, (4) give the student whose ultimate success is doubtful further opportunity to demonstrate adequate performance. An Electrical Engineering student is subject to regulations for poor academic performance from both the College of Engineering and the University of Florida. The college regulations are somewhat more restrictive than those of the university; consequently, a student may be on college probation but not necessarily on university probation. A student is placed on scholarship warning by the university if he has an UD grade point deficit of 1 to 9 points, on university probation for a deficit of 10 to 19 points, and is suspended from the university if his point deficit exceeds 19. However, an engineering student with a deficit of any magnitude (an UD average below 2.0) is immediately placed on college probation.

If an electrical engineering student is placed on college probation, the department will specify a planned program for that student's next term of enrollment. Such a planned program will generally specify that a minimum number of grade points be made up that particular quarter to ensure that the student's normal academic progress will not be impaired. The student will continue on college probation until his grade point deficit has been restored to zero. Failure to meet the terms imposed by the student's counselor in such a case will result in suspension from the Department of Electrical Engineering, but not necessarily from the university.

Academic suspension is intended to: (1) select out students whose performance indicates that they will not fulfill the requirements for graduation; and (2) encourage students to leave the university as soon as a high probability of failure is evident. A student on college probation will be suspended unless he maintains an average of 2.0 in all work attempted that quarter or maintains an average of 2.0 in all work attempted in the College of Engineering. Also, a student on probation who withdraws after the fifth week of classes will be suspended unless he has a 2.0 for all work attempted in the College of Engineering. A student re-enrolling at the university after academic suspension is automatically placed on scholarship probation.

Classification of Students

A student who has been admitted to the College of Engineering will be classified 3EG until he accumulates at least 135 hours earned with at least a 2.0 average. At that time he will be classified as 4EG. When he has earned 180 hours with a 2.0 average or above, he will be classified 5EG. Students holding a degree but who have not been admitted to graduate school will be classified 6EG.

Application for Degree

Students who expect to be graduated must file application for the degree in the registrar's office on or before the time indicated in the current university calendar. Students must make application in the quarter in which they expect to graduate, regardless of previous applications.

Residence Requirements

The minimum residence requirement for the baccalaureate degree is three quarters. Students are required to complete the last forty-five credits applied toward the baccalaureate degree during residence in the College of Engineering. Exception to this must be secured by petition to the faculty of the College of Engineering. (Correspondence courses taken as part of the last forty-five hours are in violation of the residence requirement).

Application for Admission

Application for admission to the university must be made to the Admissions Section of the Office of the Registrar. It is proper for prospective students to correspond with the Department of Electrical Engineering and the College of Engineering but such contact does not in any way eliminate the necessity for filing a formal application in the Office of the Registrar. Applications may be submitted not more than one year in advance; however, submission at least six months in advance is strongly advised. Students who are in University College must file an application to change colleges with the Office of the Registrar during the quarter in which all pre-engineering requirements will be met.

Student Organizations

There are two departmental organizations for Electrical Engineering students. The Institute of Electronic and Electrical Engineers (IEEE) has a very active undergraduate student chapter at the University of Florida. The IEEE has regular meetings during the year, hosts guest speakers from industry and government, and promotes electrical engineering throughout the university community. Eta Kappa Nu, National Electrical Engineering Honor Society, has a chapter at the University of Florida. Electrical engineering undergraduates who are outstanding scholastically and/or in extra-curricular achievements are elected to membership. Also Tau Beta Pi and Sigma Tau, both National Engineering Honor Societies, are open to electrical engineering students. Omicron Delta Kappa, Phi Kappa Phi and Florida Blue Key are campus-wide honoraries that recognize scholarship and leadership and are open to electrical engineering students.

EE Course Description

EE 301–INTRODUCTION TO ELECTRICAL ENGINEERING. 5 credits
Prerequisites: MS 303, PS 216. An introduction to systems, circuits and devices in electrical and electronics engineering.

EE 302–ELEMENTS OF ELECTRICAL ENGINEERING. 5 credits
Prerequisites: MS 303, PS 216. An introduction to the theory and practice of electrical engineering for students not majoring in electrical engineering; circuits, machines, electronics, and systems.

EE 303–TRANSFORM METHODS IN ENGINEERING. 1 credit
Prerequisite: EE 301. Characteristics and characterization of linear systems. Laplace transforms in engineering. For non-electrical engineering majors.

EE 304–ELECTRONICS SYSTEMS AND INSTRUMENTATION. 4 credits
Prerequisite: EE 301. Corequisite: EE 320. Fundamental techniques of electronic instrumentation and control systems. For non-electrical engineering majors.

EE 320–ELECTRICAL ENGINEERING LABORATORY 1. 1 credit
Prerequisite: EE 301. The first and prerequisite course in a sequence which deals with electric instrumentation, devices, and systems. This laboratory sequence complements EE courses: EE 301, 321, 322, 333, 352, 353, 361 381, 382, 441, and 474.

EE 321–ELECTRONICS 1. 3 credits
Corequisite: EE 331. Physical principles and circuit models of semiconductor devices, and vacuum and photo tubes.

EE 322–ELECTRONICS 2. 5 credits
Prerequisites: EE 321 and EE 331. Physical principles and circuit models of electronic devices, esp. semiconductor devices; linear lowpass amplifier design and analysis; bandpass amplifiers; sinusoidal oscillators.

EE 331–CIRCUITS 1. 3 credits
Prerequisite: EE 301. Linear circuit analysis, transient, and steady-state. Network theorems, power and energy, magnetically coupled circuits, two-port networks, and polyphase circuits.

EE 332–CIRCUITS 2. 3 credits
Prerequisite: EE 331. Fourier analysis, resonance, singularity functions, and Laplace transforms.

EE 333–CIRCUITS 3. 3 credits
Prerequisites: EE 322, EE 332, EE 361. Convolution, applications of Fourier and Laplace transforms, filters, noise, and state variable methods.

EE 340–ELECTRICAL ENGINEERING LABORATORY 2. 1 credit
Prerequisites: EE 320, EE 321. The second course in a sequence which deals with electric instrumentation, devices, and systems.

EE 352–ELECTROMAGNETIC FIELDS 1. 4 credits
Prerequisite: EE 301. Static electric and magnetic theory, time-varying electromagnetic fields, and application of Maxwell's equation.

EE 353–ELECTROMAGNETIC FIELDS 2. 3 credits
Prerequisite: EE 352. Maxwell's equations, wave equations, and skin effect. Propagation and reflection of waves. Antennas. Guided waves.

EE 361–INTRODUCTION TO COMPUTER SYSTEMS. 4 credits
Prerequisites: ISE 350, EE 301. Physical characteristics of analog, digital, and hybrid computers; programming systems; elementary numerical methods; simulation techniques for engineering systems.

EE 381–ELEMENTS OF ELECTRIC ENERGY ENGINEERING 1. 3 credits
Prerequisite: EE 332. Rotating energy converters and transformers. Theory and design considerations. Simple system applications.

EE 382–ELEMENTS OF ELECTRIC ENERGY ENGINEERING 2. 3 credits
Prerequisite: EE 381. Static energy converters. Elements of bulk energy system operation under steady-state conditions.

EE 420–ELECTRICAL ENGINEERING LABORATORY 3. 1 credit
Prerequisites: EE 340, EE 322, EE 332. The third course in a sequence which deals with electric instrumentation, devices, and systems.

EE 430–ELECTRICAL ENGINEERING LABORATORY 4. 1 credit
Prerequisites: EE 340, EE 352, EE 381. The fourth course in a sequence deals with electric instrumentation, devices, and systems.

EE 440–ELECTRICAL ENGINEERING LABORATORY 5. 1 credit
Prerequisite: EE 420. The fifth course in a sequence which deals with instrumentation, devices, and systems.

EE 441–COMMUNICATION SYSTEMS AND COMPONENTS. 4 credits
Prerequisites: EE 322 and EE 333. Radio, television, radar and telemetry systems.

EE 442–MODULATION AND COMMUNICATION SYSTEMS. 3 credits
Prerequisites: EE 441. Amplitude, frequency, and pulse modulated systems.

EE 443–NOISE IN DEVICES AND COMMUNICATION SYSTEMS. 3 credits
Prerequisite: EE 441. System and Fourier analysis; sampling theory; origin, characterization, and measurement of random noise.

EE 450–ELECTRICAL ENGINEERING LABORATORY 6. 1 credit
Prerequisite: EE 440. The sixth course in a sequence which deals with electric instrumentation, devices, and systems.

EE 452–TRANSMISSION LINES AND MICROWAVE CIRCUITS. 3 credits
Prerequisite: EE 353. Field and distributed circuit theories of transmission lines and waveguiding systems. N-port and 2-port junctions. Scattering and transmission matrix formulations, the Smith Chart. Impedance transformation and matching. Passive microwave devices including terminations, attenuators, phase shifters, hybrid junctions, isolators and circulators. Microwave resonators.

EE 474–LINEAR CONTROL SYSTEMS. 3 credits
Prerequisite: EE 333. Analysis and design of linear feedback control systems by root locus and frequency response methods. Controllability and observability. State variable and classical analysis of multidimensional linear systems.

EE 483–ELECTRIC ENERGY SYSTEMS 1. 3 credits
Prerequisite: EE 382. Operation of power systems under static or quasi-static conditions. Economic and geographical considerations.

EE 484–ELECTRIC ENERGY DISTRIBUTION SYSTEMS. 3 credits
Prerequisite: EE 483. Study of power distribution systems; protection, instrumentation, and metering.

EE 485–ELECTRIC ENERGY SYSTEMS 2. 3 credits
Prerequisite: EE 484. Electric energy transmission. Steady-state load flow analysis and control. Optimum dispatch considerations.

EE 491–CREATIVE PROBLEM SOLVING. 3 credits
Development of a problem solving approach for complex electrical engineering problems with emphasis on creative techniques and the writing of meaningful engineering reports.

EE 493–ELECTRICAL DESIGN AND EXPERIMENTAL PROCEDURE.
Prerequisite:Approval of instructor. Special projects are studied and reports prepared thereon. 1 to 6 credits

EE 494–ELECTRICAL DESIGN AND EXPERIMENTAL PROCEDURE
Second half of the course EE 493-494. 1 to 6 credits

EE 498–SPECIAL PROBLEMS IN ELECTRICAL ENGINEERING
Prerequisite: Recommendation of Department Chairman. Selected problems or projects in the student's major field of engineering study. May be repeated to the maximum of 12 credits. 1 to 6 credits

EE 499–PRACTICAL WORK IN ELECTRICAL ENGINEERING.
Prerequisite: 4 EG classification: one term industrial employment, including extra work according to a pre-approved outline. Practical engineering work under industrial supervision, as set forth in the College of Engineering Regulations. 1 to 5 credits

Courses for Advanced Undergraduates and Graduates

EE 510–GEOMETRIC OPTICS FOR ENGINEERS. 3 credits*
The concept of light rays in determining image formation by lenses and optical instruments; aberration theory; optical instruments.

EE 522–TRANSISTOR ELECTRONICS. 3 credits*
Pre or corequisite: Undergraduate course in electronics or consent of the instructor. The electrical characteristics and circuit application of transistors.

EE 523–TRANSISTOR ELECTRONICS LABORATORY. 1 credit*
The laboratory for the corequisite course EE 522, Transistor Electronics.

EE 524–PULSE CIRCUITS LABORATORY. 1 credit*
The laboratory for the course EE 525, Pulse Circuits. Required of all students enrolled in EE 525, except at GENESYS centers where facilities are unavailable.

EE 525–PULSE CIRCUITS. 3 credits*
Design of nonlinear wave shaping circuits. Counting and gating circuits.

EE 526–APPLICATIONS OF PULSE CIRCUITS. 3 credits*
Prerequisite: EE 525. The application of pulse and logic circuits in system design. Two hour lecture and three hour laboratory.

EE 527–INTEGRATED CIRCUITS. 4 credits*
Theory and fabrication of integrated circuits and devices. Laboratory.

EE 528–PHYSICAL ELECTRONICS FOR ENGINEERS 1. 4 credits*
Prerequisite: EE 522. Engineering applications of phenomena such as piezo-electric effect, photoconductivity, electron emission, etc., to electronic devices. Laboratory.

*Available for graduate major credit.

EE 529–PHYSICAL ELECTRONICS FOR ENGINEERS 2. 4 credits*
Prerequisite: EE 528. Continuation of EE 528. Laboratory.

EE 551–ANTENNA SYSTEMS. 3 credits*
Prerequisite: Undergraduate course in fields and waves. Electromagnetic field theory and its application to antenna design. Elemental antennas. Antenna systems. Horns, paraboloid, slot, electomagnetic lens antennas.

EE 555–MICROWAVE LABORATORY. 1 credit*
The laboratory for the corequisite course EE 556, Microwave Techniques.

EE 556–MICROWAVE TECHNIQUES. 4 credits*
Prerequisite: Undergraduate required sequence in electronics. Waveguides and resonant cavities. Methods of generating, transmitting and receiving microwaves.

EE 558–APPLICATIONS OF MAGNETISM. 3 credits*
Pre or corequisite: EE 451. Properties and processes in magnetic materials are introduced through examples such as inductors, pulse transformers, memory elements, microwave components, domain devices.

EE 561–DIGITAL COMPUTER PRINCIPLES 1. 4 credits*
Switching algebra and its application to the design of circuits.

EE 562–DIGITAL COMPUTER PRINCIPLES 2. 4 credits*
Prerequisite: EE 561. Digital computer components, organizations, and operation.

EE 563–DIGITAL COMPUTER PRINCIPLES 3. 4 credits*
Prerequisite: EE 561. Program coding techniques and algorithms.

EE 570–CONTROL SYSTEM THEORY AND PRACTICE. 3 credits*
Prerequisite: EE 474. Nonlinear control systems, Liapunov's Direct Method, and describing functions. Signal modulated systems. Static and dynamic optimization. Use of dynamic programming and Pontryagin's Maximum Principle in control.

EE 571–SYNTHESIS OF LINEAR CONTROLS 3 credits*
Prerequisite: EE 474. Design of continuous and sampled data control systems with frequency domain and root locus methods. Analytic design methods. Synthesis of controllers for discrete and continuous systems and stochastic input.

EE 581–ELECTRIC ENERGY SYSTEM INSTRUMENTATION. 3 credits*
Instrumentation and equipment for control and protection of electric power system components. Carrier and other types of communication systems and their applications to the electric power industry.

EE 591–SPECIAL TOPICS IN ELECTRICAL ENGINEERING 1.
Prerequisite: Graduate standing or permission of instructor for seniors. Laboratory, lectures, or conferences covering specially selected topics in electrical engineering. 1 to 4 credits*

EE 592–SPECIAL TOPICS IN ELECTRICAL ENGINEERING 2.
1 to 4 credits*
The second half of the course EE 591-592.

*Available for graduate major credit.

Graduate Courses

EE 600–ELEMENTS OF LINEAR SYSTEMS.	3 credits
EE 601–ADVANCED SYSTEM THEORY 1.	3 credits
EE 602–ADVANCED SYSTEM THEORY 2.	3 credits
EE 611–PHYSICAL OPTICS FOR ENGINEERS 1.	3 credits
EE 612–PHYSICAL OPTICS FOR ENGINEERS 2.	3 credits
EE 613–LASER TECHNOLOGY.	3 credits
EE 614–ELECTRO-OPTICS	3 credits
EE 621–SEMICONDUCTOR JUNCTION DEVICES.	3 credits
EE 622–ELECTRONIC CIRCUITS 1.	3 credits
EE 623–ELECTRONIC CIRCUITS 2.	3 credits
EE 624–ELECTRONIC CIRCUITS 3.	3 credits
EE 625–MODELS AND APPLICATIONS OF SOLID-STATE DEVICES 1.	3 credits
EE 626–MODELS AND APPLICATIONS OF SOLID-STATE DEVICES 2.	3 credits
EE 628–FLUCTUATION PHENOMENA 1.	3 credits
EE 629–FLUCTUATION PHENOMENA 2.	3 credits
EE 630–ADVANCED CIRCUIT ANALYSIS.	3 credits
EE 631–GENERALIZED NETWORK THEORY.	3 credits
EE 632–NONLINEAR CIRCUITS.	3 credits
EE 634–INTRODUCTION TO NETWORK SYNTHESIS.	3 credits
EE 635–MODERN FILTER SYNTHESIS.	3 credits
EE 636–TRANSFER FUNCTION SYNTHESIS.	3 credits
EE 640–NOISE IN LINEAR SYSTEMS.	3 credits

EE 641–THEORY OF COMMUNICATION 1.	3 credits
EE 642–THEORY OF COMMUNICATION 2.	3 credits
EE 643–SIGNAL REPRESENTATION.	3 credits
EE 644–SIGNAL DESIGN.	3 credits
EE 645–STATISTICAL DECISION THEORY.	3 credits
EE 646–SPACE COMMUNICATIONS.	3 credits
EE 647–INFORMATION THEORY.	3 credits
EE 648–ERROR CORRECTING CODES.	3 credits
EE 651–ELECTROMAGNETIC FIELDS AND WAVES.	3 credits
EE 652–ANTENNAS AND WAVE PROPAGATION.	3 credits
EE 653–WAVE PROPAGATION IN PLASMAS.	3 credits
EE 655–ACTIVE MICROWAVE DEVICES.	3 credits
EE 656–WAVEGUIDES AND MICROWAVE NETWORKS.	3 credits
EE 657–COUPLED MODE THEORY.	3 credits
EE 660–FOUNDATIONS OF INFORMATION SCIENCE.	3 credits
EE 661–ANALYSIS AND SYNTHESIS OF COMBINATORIAL SWITCHING CIRCUITS.	3 credits
EE 662–SEQUENTIAL SWITCHING CIRCUIT DESIGN.	3 credits
EE 663–INTRODUCTION TO AUTOMATA THEORY–FINITE-STATE MACHINES.	3 credits
EE 664–PATTERN RECOGNITION THEORY 1.	3 credits
EE 665–ELECTRONIC ANALOG AND HYBRID COMPUTERS 1.	3 credits
EE 666–ELECTRONIC ANALOG AND HYBRID COMPUTERS 2.	3 credits
EE 667–ELECTRONIC ANALOG AND HYBRID COMPUTERS 3.	3 credits
EE 668–DIGITAL SYSTEMS CONTROL.	3 credits
EE 669–PATTERN RECOGNITION THEORY 2.	3 credits
EE 670–MODERN CONTROL THEORY 1.	3 credits
EE 671–MODERN CONTROL THEORY 2.	3 credits
EE 672–MODERN CONTROL THEORY 3.	3 credits
EE 676–INERTIAL GUIDANCE AND CONTROL.	3 credits
EE 679–NONLINEAR CONTROL SYSTEMS.	3 credits
EE 680–ADVANCED ELECTRIC ENERGY SYSTEMS 1.	3 credits
EE 681–ADVANCED ELECTRIC ENERGY SYSTEMS 2.	3 credits
EE 682–ADVANCED ELECTRIC ENERGY SYSTEMS 3.	3 credits
EE 685–ADVANCED ELECTRICAL MACHINERY.	3 credits
EE 687–ADVANCED ELECTRICAL MEASUREMENTS.	4 credits
EE 691–SPECIAL TOPICS IN ELECTRICAL ENGINEERING.	1 to 6 credits Maximum 18 credits

EE 691–SPECIAL TOPICS IN ELECTRICAL ENGINEERING	1 to 6 credits Maximum 18 credits
EE 692–SPECIAL TOPICS IN ELECTRICAL ENGINEERING	1 to 6 credits Maximum 18 credits
EE 695–GRADUATE SEMINAR.	1 credit. Maximum 4 credits
EE 699–MASTER'S RESEARCH.	1 to 15 credits
EE 799–DOCTORAL RESEARCH.	1 to 15 credits

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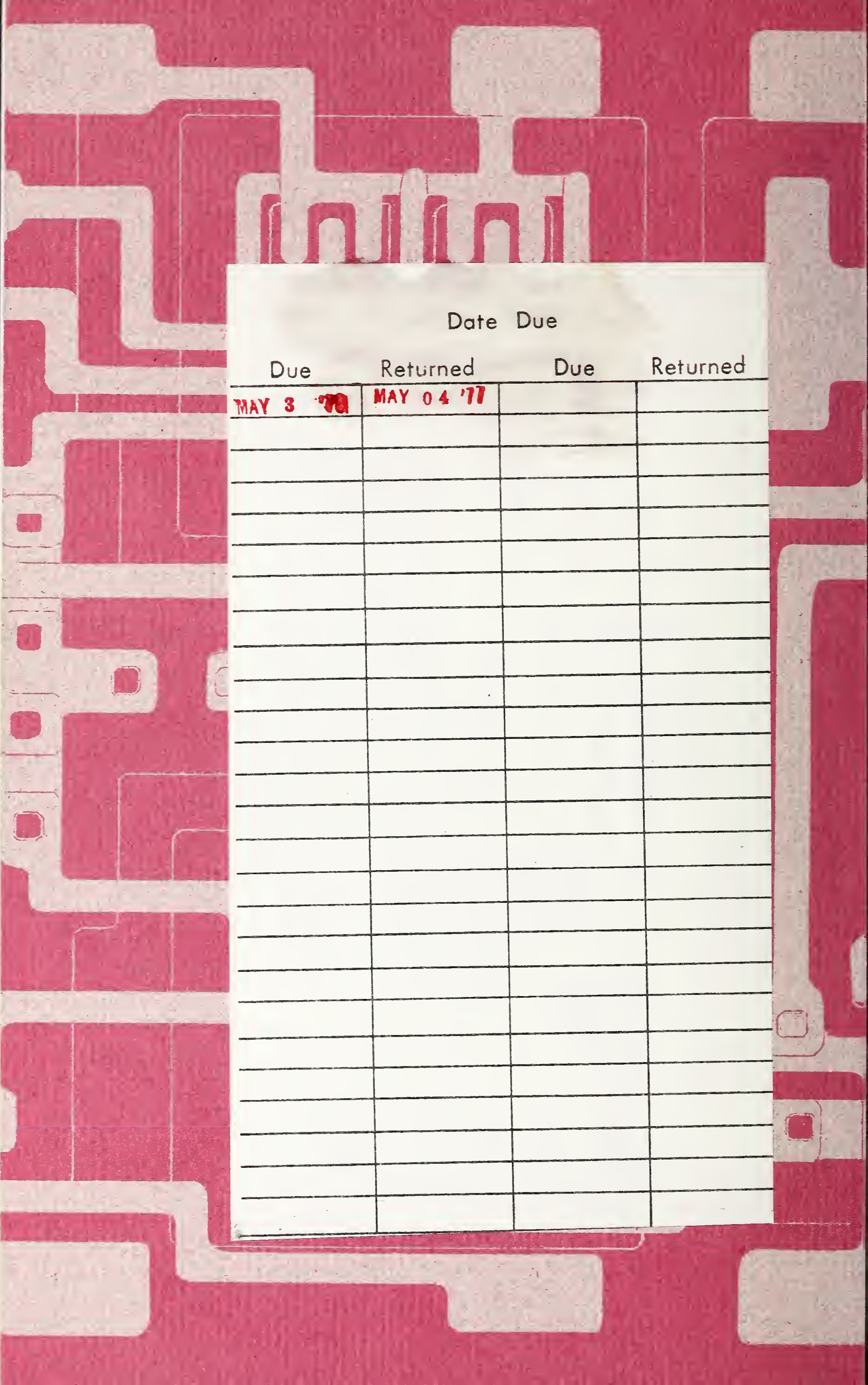

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